REMARKS

In response to an objection, the final sentence of the Abstract has been deleted.

Claim 1 has been amended to recite the features of claims 2-5, now cancelled. In view of the cancellation of claims, the dependency of claims 6, 8, and 9 has been amended. Claim 11 has been amended to recite the features of claims 12 and 13, now cancelled. Claim 14 is amended to be dependent upon claim 11. Claims 16 has been amended to more particularly point out that the method determines a cross count value based upon the number of times that the voltage from the oxygen sensor crosses the cross-count voltage of a predetermined time period, and then compares the cross count value to a pre-set threshold for confirm operation of the sensor, features originally in claim 21, now cancelled.

Also, claims 1 and 11 are amended to clarify that the oxygen sensor is part of the vehicle.

Claims 12 and 22 are amended to clarify the voltage measurement, and claims 7, 10, 13, 15, 17, 18 and 19 have been amended to clarify references to antecedents, as discussed below.

Objection to Specification

In view of the deletion of the final sentence of the Abstract, it is respectfully requested that the objection be withdrawn.

Claim Rejection under 35 USC § 112

Claims 7, 10, 12, 13, 15, 17-19 and 22 were rejected under35 USC § 112 for indefiniteness.

In particular, with regard to claims 12 and 22, language regarding a voltage measurement was deemed misdescriptive. The claims have been amended to clarify that the measurement between the upper voltage and the lower voltage.

With regard to claims 7, 10, 13, 15, 17, 18 and 19, references to antecedents were deemed indefinite. Claim 7 has been amended to refer to "said engine RPM;" claim 10 has been amended to refer to "said first set of instructions;" claim 13 has been amended to refer to "said second time period;" claim 15 has been amended to refer to "said sensor temperature;" claim 17 has been amended to clarify that the pre-validation test includes testing for stored engine codes; claim 18 has been amended to clarify that the pre-validation test includes testing for sensor temperature; and claim 19 has been amended to clarify that the pre-evaluation test includes determining sensor temperature. With regard to other specifically mentioned claims, where the terms have been incorporated into another claim by amendment, attention was paid to address the concern of the rejection.

The remaining claims were includes in the rejection as dependent upon a rejected claim.

In view of the amendments, it is requested that the rejection be withdrawn, and that the claims be allowed.

Claim Rejection Heuston et al., alone or with Tamura

Claims 1, 6-9, 11, and 13 were rejected under 35 U.S.C. § 102(b) as anticipated by United States Patent No. 5,585,552, issued to Heuston et al. in 1996. Claims 5, 10, and 15-22 were rejected under 35 U.S.C. § 103 based upon Heuston et al. in view of United States Patent No. 4,928,518, issued to Tamura in 1990. In view of the amendments to the claims, it is appropriate to address the rejections concurrently.

Heuston et al. relates to a diagnostic method for power plants, including automotive engines, which include an oxygen sensor 101, and describes a test for oxygen sensor function beginning at col. 4, line 50. The test comprises interrupting normal engine operation by creating a lean engine operating condition by vacuum leak, col. 5, lines 25-30; and then creating a rich engine operating condition by feeding additional fuel via the vacuum leak, col. 5, lines 33-37; and analyzing the response time, col. 5, lines 41-58. Although Heuston et al. notes the difference in waveforms between good and bad sensors, the only test is the maximum voltage drop between the artificial events, col. 59-65. In contrast, the diagnostic heuristic in Applicant's invention is intended to be carried out on an engine during normal operation. Moreover, Applicant's diagnostic heuristic includes correlating sensor data with engine throttle position. Heuston et al. is directed only to response time between contrived events, and does not provide for correlation to throttle position. Nor would such be meaningful, given the staged nature of the events.

The secondary reference, Tamura, shows a diagnostic routine that considers

engine operation. However, Tamura looks at engine speed as determined by crank angle sensor, col. 4, lines 13-15. Tamura does disclose that the engine system includes a throttle position sensor 126, col. 3, lines 15-16, but does not use this data in evaluating the oxygen sensor. Thus, even when combined with Heuston et al., these references cannot point the practitioner to the aspect of Applicant's invention that includes correlating throttle position and the difference between the maximum and minimum voltages.

Still further, another aspect of Applicant's invention evaluates sensor operation by setting a cross-count voltage, determining a cross count value based upon the number of times the sensor voltage crosses the cross-count voltage over a time period, and comparing the cross count value to a pre-set threshold. Heuston et al. discusses waveform characteristics for the sensor, including cross-count transition numbers, col. 6, lines 26-41. However, Heuston et al. recognizes that cross-counts depend on factors including system type and engine RPM, col. 6, lines33-37. Moreover, Heuston et al. only looks to cross-counts after first determining that the oxygen sensor is properly function, and then uses waveform characteristic to diagnose other problems with system, col. 6, lines 9-13. Nothing in Heuston et al. points to cross-count values as a way to determine if the sensor is properly functioning. Tamura is silent as to cross-count values. Thus, the references do not teach or suggest this aspect of Applicant's invention.

Claim 1 is directed to Applicant's diagnostic testing system that includes an analyzer that receives, via a communication link, data from an oxygen sensor and also

engine throttle position. The claim also recites a diagnostic heuristic that correlates the engine throttle position with the data from the oxygen sensor and measures a time period between the upper and lower voltages. Heuston et al. interrupts normal engine operation with staged events intended to establish known conditions within the engine, and so does not need to correlate the data to engine operation, particularly throttle position. Tamura discloses a throttle position sensor, which provides data for purpose of engine control, but uses engine speed determined by a crank angle sensor in assessing oxygen sensor function, and not the throttle position. Thus, even when read together, Heuston et al. and Tamura do not lead the practitioner to Applicant's diagnostic testing system in claim 1.

Claims 6-10 are dependent upon claim 1, and not taught or suggested by the references for the reasons set forth with regard to that claim, and also recite additional features preferred in the practice of Applicant's invention. Attention is particularly directed to claim 6, wherein the diagnostic heuristic includes a cross-count voltage and uses the number of counts that matche the cross-count voltage within a time period, a feature not shown in the references, as discussed below.

Claim 11 is directed to an aspect of Applicant's invention that includes a diagnostic heuristic that includes a first test to determine a first time period between the upper and lower voltages, and a second test to determine number of counts wherein the voltage matches a cross-count voltage within a second time period. Heuston et al. determines oxygen sensor function by fabricating events, and analyzing voltage fluctuations. Heuston et al. teaches that waveform characteristics and cross-counts are

only useful after first determining that the oxygen sensor is functioning correctly, and then only to detect other problems with the system, col. 6, lines 9-13. Moreover, Heuston et al. recognizes that cross-count transitions vary with system type, engine speed and other factors, col. 6, lines 33-39, and so does not point the practitioner to use the cross-count number to determine proper sensor operation. Tamura determines whether sensor voltage is within a desired range for predetermined engine operating conditions, and does not determine cross-count voltage numbers. Thus, even if the references are combined, they do not point the practitioner to Applicant's diagnostic testing system in claim 11, or claims 14 and 15 dependent thereon.

Claim 16 is directed to Applicant's method for diagnostic testing of an oxygen senor. The method includes a diagnostic test that correlate engine throttle position with data from said oxygen sensor. For the reasons set forth above with regard to claim 1, neither Heuston et al. nor Tamura nor their combination shows correlating oxygen sensor data with engine throttle position in diagnosing sensor function. Claim 16 also calls for determining a cross count value based upon the number of times the voltage crosses a set cross-count voltage. For the reasons set forth with regard to claim 11, Heuston et al. does not use cross-count values to diagnose sensor function, and Tamura does not discuss cross-count values. Thus, the references do not point the practitioner to Applicant's method in claim 16, or in claims 17-20 and 22 dependent thereon.

Accordingly, it is respectfully requested that the rejection of the claims based upon Heuston et al. and Tamura be reconsidered and withdrawn, and that the claims be

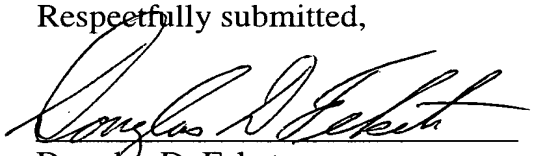
allowed.

Conclusion

It is believed, in view of the amendments and remarks herein, that all grounds of rejection of the claims have been addressed and overcome, and that all claims are in condition for allowance. If it would further prosecution of the application, the Examiner is urged to contact the undersigned at the phone number provided.

The Commissioner is hereby authorized to charge any fees associated with this communication to Deposit Account No. 50-0831.

Respectfully submitted,



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AMENDMENTS TO THE DRAWINGS

Please substitute the enclosed sheets 1/10, 7/10 and 9/10, labeled "Replacement Sheets," for the corresponding sheets 1, 7 and 9 (of 10) presently in the case.

Fig. 1 was objected to as showing rectangles for structural elements without providing descriptive legends. The figure has been amended to provide legends for the bus, module and engine. Figs. 9 and 13 were deemed illegible and have been redrafted with enhanced definition.

In view of the amendments to the figures, it is requested that the amended drawings be accepted, and that the objections be withdrawn.